Analyzing Nitrogen Use Efficiency in Canola Hybrids Under Multiple Nitrogen Fertilization Rates in Canadian Prairies

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INTRODUCTION

- Canola (*Brassica napus* L.) is the major oilseed crop in western Canada and occupies almost half the arable lands.
- Excessive Nitrogen (N) application increases production costs, induces canola crop lodging, reduces seed yield and quality, and increases N losses from the agroecosystem[1-3].
- Knowledge about N-related processes in canola is a key element for optimizing and maintaining the balance in system.
- Lack of information in this area of research provides an opportunity to study N use.
- Nitrogen Use Efficiency (NUE) is the indication of how effectively plant utilizes N to produce yield. Other ways to express NUE are: Nitrogen Harvest Index (NHI), Nitrogen Nutrition Index (NNI), Specific Leaf Nitrogen (SLN).

OBJECTIVES

- To establish N uptake and response in two hybrid varieties under different fertilizer applications: placement, timing, and N-rates.
- To assess N content in plant organs during several growth stages.
- To assess N partitioning from vegetative organs to seed yield under low versus high N scenarios (year 2).
- To assess NUE using NHI and NNI, by relating whole plant and leaf area N in canola to organ-based tissue tests (% N concentration and relative N content).

MATERALS & METHODS

- **2** commercial cultivars: **PV 581 GC, PV 533 G**
- **4** replications, Randomized Complete Block Design (RCBD)
- **2** sites: Agriculture and Agri-Food Canada Research farms at **Melfort** and **Scott**, SK
- Targeted plant density - 80 plants per m^{-2}
- N analysis – **combustion** (LECO)
- N fertilizer: **Urea (46-0-0)**
- **2** N splits: pre-plant only, pre-plant + top dressing at 4 - 6 leaf stage (electric hand spinner)
- Five samplings: **1)** end of bolting – beginning of flowering, **2)** flowering – pod formation, **3)** end of flowering or pod filling, **4)** pod maturation, **5)** physiological maturity
- Partitions: stem, leaf, pod, seeds, pod walls

(a) Sampling 2 plants per plot, cut at the ground level

(b) Stored in the chamber with controlled environment when processing

N TREATMENTS FOR THE EXPERIMENT

1. 0 kg/ha (control)
2. 50 kg/ha at seeding
3. 100 kg/ha at seeding
4. 150 kg/ha at seeding
5. 200 kg/ha at seeding
6. 50 at seeding + 50 kg/ha (4-6 leaf stage)
7. 50 at seeding + 100 kg/ha (4-6 leaf stage)
8. 50 at seeding + 150 kg/ha (4-6 leaf stage).

(c) Plants partitioned into different parts. Stem length is measured. Leaves are counted

(d) LI – 3100C Area Meter - for measuring the leaf area. To relate N content to the total leaf area

(e) Dried at 70 – 80 °C until constant weight. Dry weight of biomass was recorded

(f) Wiley mill with 1 mm screen (for the large samples). Laboratory grinders or coffee grinders for small or oily samples (leaves, seeds)

(g)

(h)

Pictures (g-h): using Leco in order to determine total N content within plant tissues

PRELIMINARY RESULTS

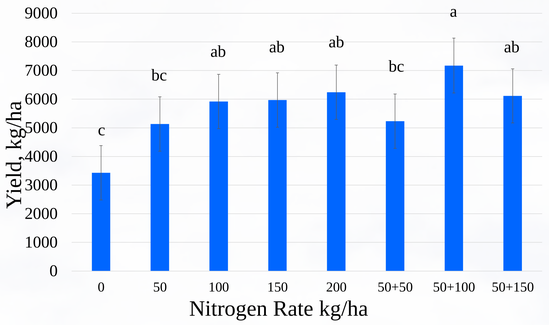

Figure 1. The chart indicates canola yield harvested from two sites (Melfort and Scott) and two hybrids. Letters a, b, and c indicate differences in seed yield at the 0.05 significance level.
kg/ha x 0.89 = lb/ac (conversion to imperial units)

Preliminary results show significant differences in canola seed yield in relation to N treatment. However differences between sites and varieties do not impact yield significantly, thus the bar chart is constructed using the averaged data from two sites and two varieties.

CONCLUSIONS

A total N content needs to be measured in more than 1900 ground samples. When the data is obtained – the further analysis can be continued in order to calculate nitrogen use efficiency.

REFERENCES

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4. Background picture retrieved from: www.canolacouncil.org

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